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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/081,661	02/22/2002	Soo-geun Lee	SAM-0313	2089

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Steven M. Mills
MILLS & ONELLO LLP
Suite 605
Eleven Beacon Street
Boston, MA 02108

EXAMINER

NGUYEN, HA T

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 03/06/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/081,661	LEE ET AL.	
	Examiner	Art Unit	
	Ha T. Nguyen	2812	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☐ Claim(s) _____ is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to applicant

1. Applicants' Amendment and Response to the Office Action mailed 10-24-02 has been entered and made of record (Paper No. 4).

Response to Amendment

2. Applicants' arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicants argued Lui's layer 78 is used to protect the vertical side walls, it does not protect a portion of the etching stopper exposed at the bottom of the via hole, it does not fill the via hole. The examiner disagreed, as clearly shown in Figs. 8 and 9, the liner 78 inherently protects the etching stopper 62 at the bottom of the via hole because it was present during the etching of the second insulating layer and was removed only after the formation of the trench (see Fig. 10). Lui satisfies the claimed limitation "filling the via hole" because layer 78 does fill the via hole, the claims do not require the protective layer to fill up the via hole. Therefore, the combined teaching of Lui with the other references used do make obvious the claimed invention of claims 1-18.

Applicants are referred to the modified ground of rejection given below.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor

and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103[©] and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lui (U.S. Patent 6391761) in view of Bothra et al. (U.S. Patent 6221759, hereinafter "Bothra").

[Claim 1] Referring to Figs. 4-11 and related text, Lui discloses a method of fabricating an interconnection line in a semiconductor device comprising the steps of : forming a first etching stopper 62 on a lower conductive layer 58 which is formed on a semiconductor substrate 50; forming a first interlayer insulating layer 66 on the first etching stopper; forming a second etching stopper 70 on the first interlayer insulating layer; forming a second interlayer insulating layer 74 on the second etching stopper ; etching the second interlayer insulating layer, the second etching stopper, and the first interlayer insulating layer sequentially using the first etching stopper as an etching stopping point to form a via hole (see Fig. 7); forming a protective layer 78 to protect a portion of the first etching stopper exposed at the bottom of the via hole, the protective layer filling the via hole; etching a portion of the second interlayer insulating layer adjacent to the via hole using the second etching stopper as an etching stopping point to form a trench connected to the via hole (see Fig. 9); removing the protective layer; removing the portion of the first etching stopper positioned at the bottom of the via hole (see Fig. 10); and forming an upper conductive layer 94 that fills the via hole and the trench and is electrically connected to the lower conductive layer (See Fig. 11). But it does not disclose expressly that the via hole is aligned with lower conductive layer. However, the missing limitation is well known in the art because Bothra discloses this feature (See fig. 2j). A person of ordinary skill is motivated to modify Lui with Bothra to obtain higher circuit density.

[Claims 2 and 18] Bothra also discloses the lower and upper metal conductive layers are of copper (see col. 5, lines 27-30 and col. 8, lines 12-34).

[Claims 3 and 6] Liu also discloses wherein the first and second etch stoppers are formed of at least one of silicon nitride or carbide (see col. 3, lines 60-67 and col. 4, lines 8-18); and

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[Claims 4, 5, 7, and 8] wherein the first and second interlayer insulating layers are formed of a low dielectric constant material (see col. 4, lines 1-25), besides, the examiner takes Official Notice that carbon doped silicon oxide is a low k dielectric commonly used in semiconductor devices.

Therefore, it would have been obvious to combine Lui with Bothra to obtain the invention as specified in claims 1-8 and 18 .

6. Claims 9, 10, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lui in view of Bothra, as applied to claims 1-8 above, and further in view of Nashner et al. (U.S. Patent 6465358, hereinafter "Nashner").

The combined teaching of Lui and Bothra discloses substantially the limitations of claims 9, 10, and 14, as shown above. It also disclose an inorganic dielectric protective layer (see col. 4, lines 42-62).

But it does not disclose expressly that the dielectric protective layer is of spin-on type, and that the protective layer is removed by a wet etching using a HF solution diluted with water.

However, the missing limitations are well known in the art because Nashner discloses this feature (See col. 4, lines 17-32 and col. 6, line 45-col.7, line 29), besides the examiner takes Official Notice that HSQ is one of the SOG materials commonly used in semiconductor devices .

A person of ordinary skill is motivated to modify Lui and Bothra with Nashner to obtain better etch control and device with less contaminants or residues.

Therefore, it would have been obvious to combine Lui and Bothra with Nashner to obtain the invention as specified in claims 9, 10, and 14.

7. Claims 11-13 and 15-17 are rejected under 35 U.S.C. 103(a) as being unpatentable Lui in view of Bothra, as applied to claims 1-8 and 18 above, and further in view of Liu et al. (U.S. Patent 6323121, hereinafter "Liu").

The combined teaching of Lui and Bothra discloses substantially the limitations of claims 11-13, and 15-17, as shown above.

But it does not disclose expressly the details about the forming of the protective layer.

However, the missing limitations are well known in the art because Liu discloses these features (See Figs. 1C and D). The examiner takes official notice that both oxygen plasma and TMAH resist developer are commonly used in the art to remove organic material, depending on the cost and quality requirements, the use of either method is done to meet these specific requirements. In the case the protective layer is an oxide, dilute HF is a commonly used method of cleaning.

A person of ordinary skill is motivated to modify Lui and Bothra with Liu to obtain the desired etch selectivity, for example if the first and second insulating layers are of inorganic low k material, organic protective layer is preferable .

Therefore, it would have been obvious to combine Lui and Bothra with Liu to obtain the invention as specified in claims 11-13 and 15-17.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706 . The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen
Primary Examiner
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